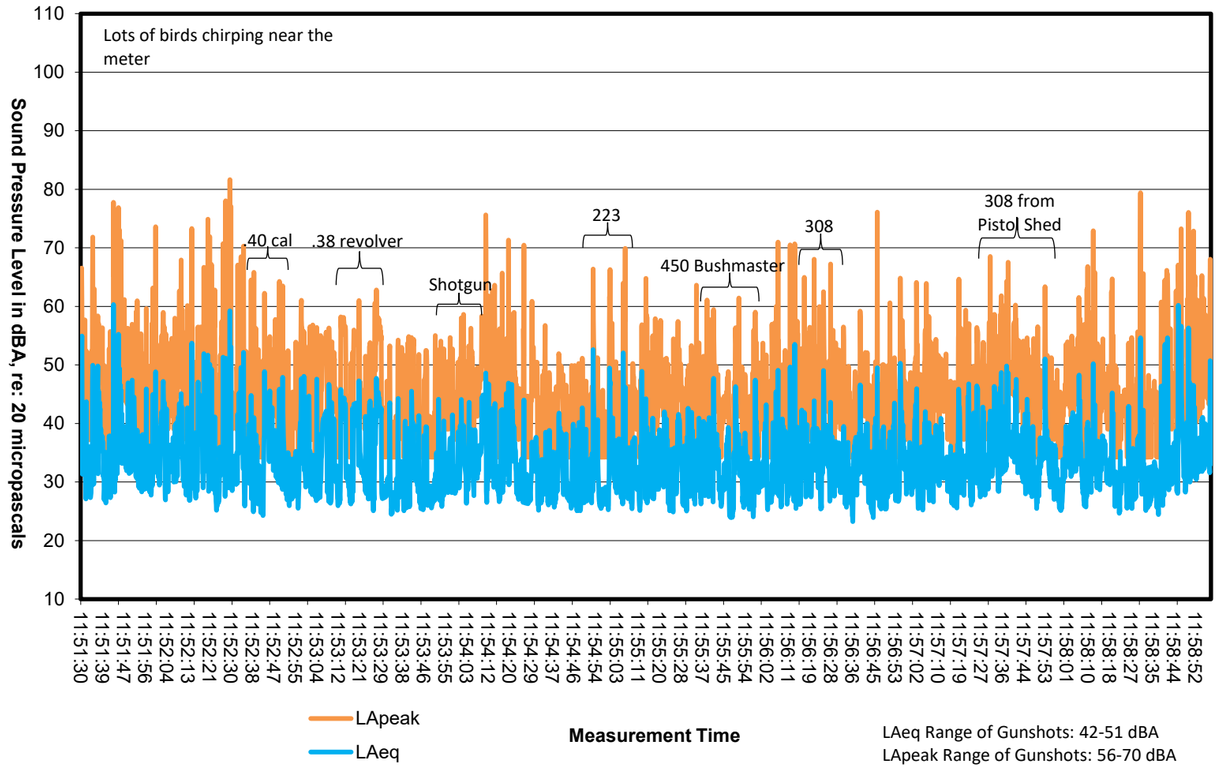
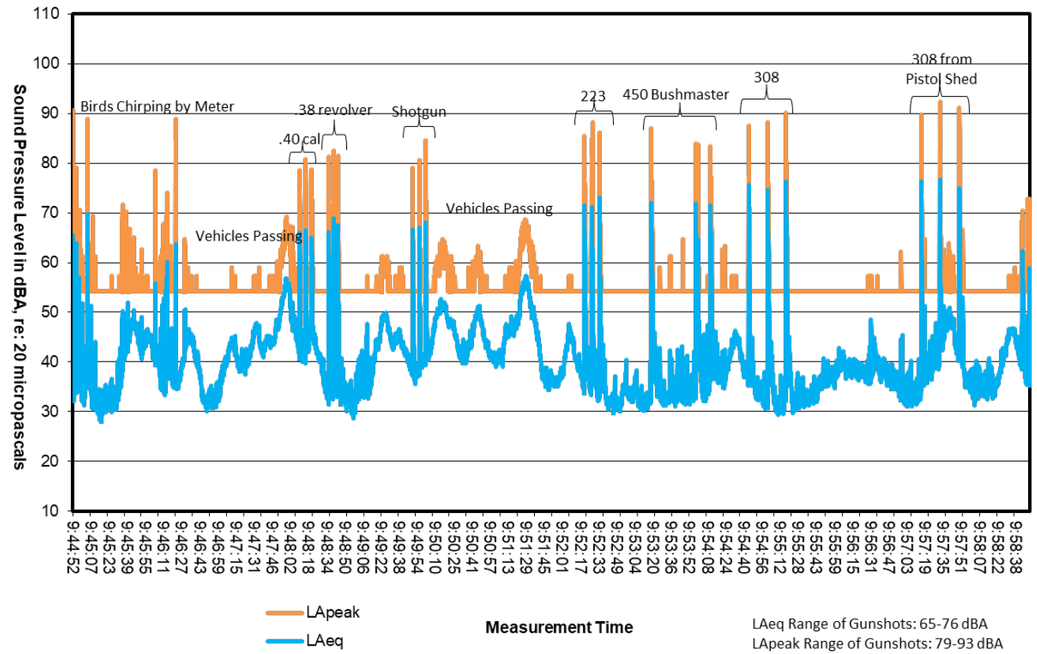
ECHO POINT SHOOTING RANGE
Allegan, Michigan
May 13, 2021
File: EchoPt04_005
Measurement Location: AS1B
Notes: Shots Audible

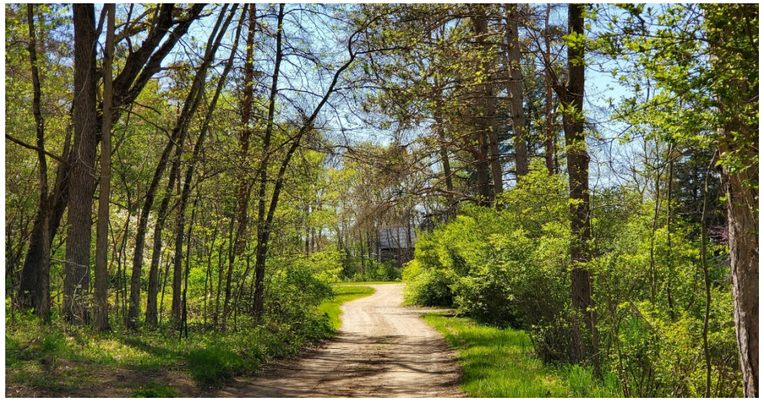


AS 1B approximately 0.65 miles north of the range at the in the parking lot of the residence at 118th Avenue on the north side of the street in the parking area in front of the studio.

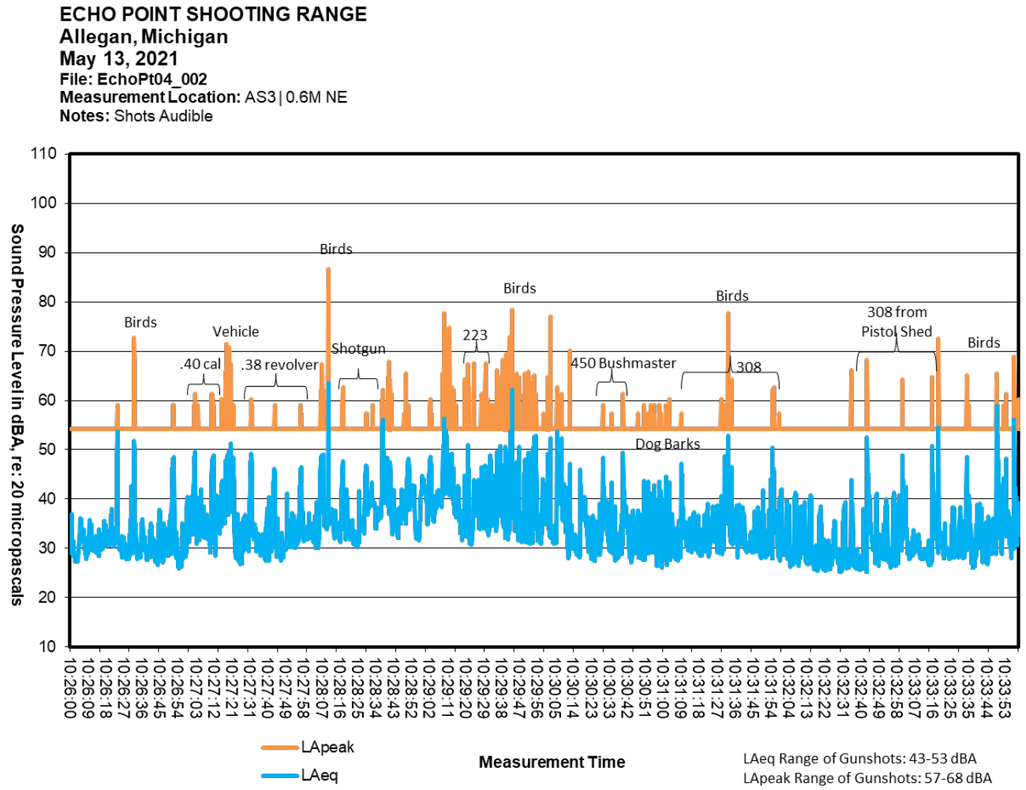
AS 2 approximately 0.29 miles northeast of the range in the back yard of the residence at 3629 Bay View Drive.

ECHO POINT SHOOTING RANGE
Allegan, Michigan
May 13, 2021
File: EchoPt04_001
Measurement Location: AS2 | 0.3M NE
Notes: Shots Audible





AS 3 approximately 0.61 miles northeast of the range near the residential property at the west end of 3585 Shoreline Drive.



APPENDIX D: SUMMARY OF WEATHER CONDITIONS DURING THE ACOUSTICAL MESAUREMENTS MADE AT THE EXISTING RANGE SITE IN 2016 AND 2021

Table D-1. Summary table of weather conditions at the existing range site during the field measurements in 2016 and 2021.

Date	Time	Temperature (°F)	Barometric Pressure (inches of mercury)	Relative Humidity %	Wind Speed (mph)
2016					
09/28/16	9:41 am	62	29.15	57%	1 to 2
09/28/16	10:38 am	62	29.15	57%	1 to 2
09/28/16	11:14 am	61	29.19	69%	0 to 1.5
2021					
05/16/21	9:36 am	57	29.73	31%	1 to 2
05/16/21	10:05 am	59	29.74	39%	0 to 2.7
05/16/21	10:35 am	61	29.73	31%	0 to 2.7
05/16/21	11:22 am	61	29.70	20%	0 to 1.6
05/16/21	12:03 pm	63	29.71	27%	0 to 2.7

APPENDIX E: SUMMARY OF WEAPONS DATA USED IN THE COMPUTER MODEL STUDIES

Weapons used on the proposed 25-yard and 100-yard ranges

.223 Rifle
12-gauge Shotgun
.44 Handgun

Octave Band Sound Exposure Level Data for M-16 with .223 Rem. 55gr. power-locked hollow point rounds at a distance of 13 ft (4 meters)

Receiver Direction Relative to Direction of Gunfire	Octave Band Sound Exposure Level in dB					
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Front	109	118	121	121	118	115
Front/Side[1]	106	114	117	117	115	112
Side	103	109	112	113	112	109
Rear/Side[2]	100	106	109	110	110	107
Rear[4]	96	102	105	107	108	104

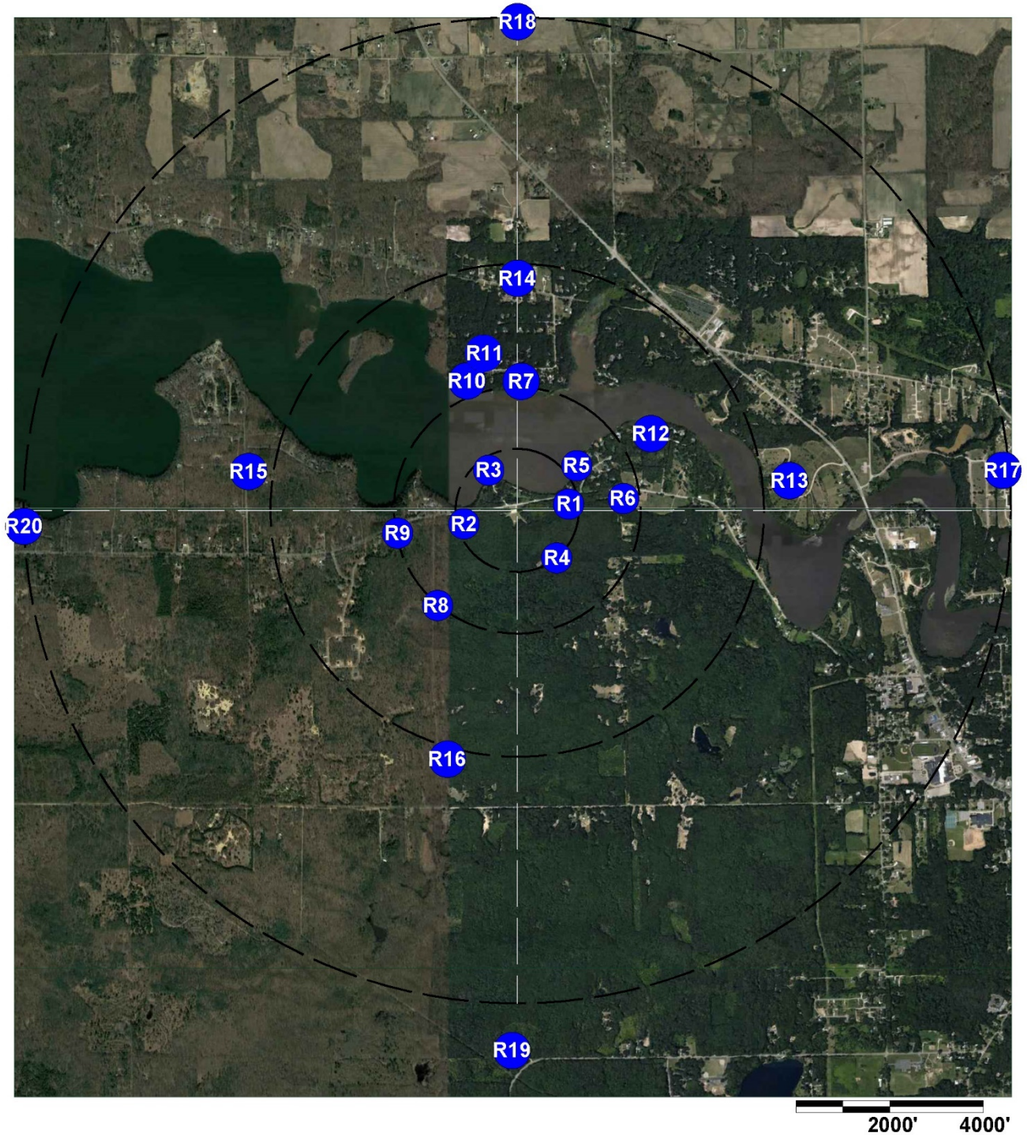
Octave Band Sound Exposure Level Data for a 12-gauge shotgun at a distance of 13 ft (4 meters)

Receiver Direction Relative to Direction of Gunfire	Octave Band Sound Exposure Level in dB					
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Front	111	118	119	119	116	112
Front/Side[2]	106	113	114	114	112	110
Side	101	108	109	109	109	107

Octave Band Sound Exposure Level Data for a .44 Remington Magnum with a 200 gr. hollow point hunting load ammunition at a distance of 13 ft (4 meters)

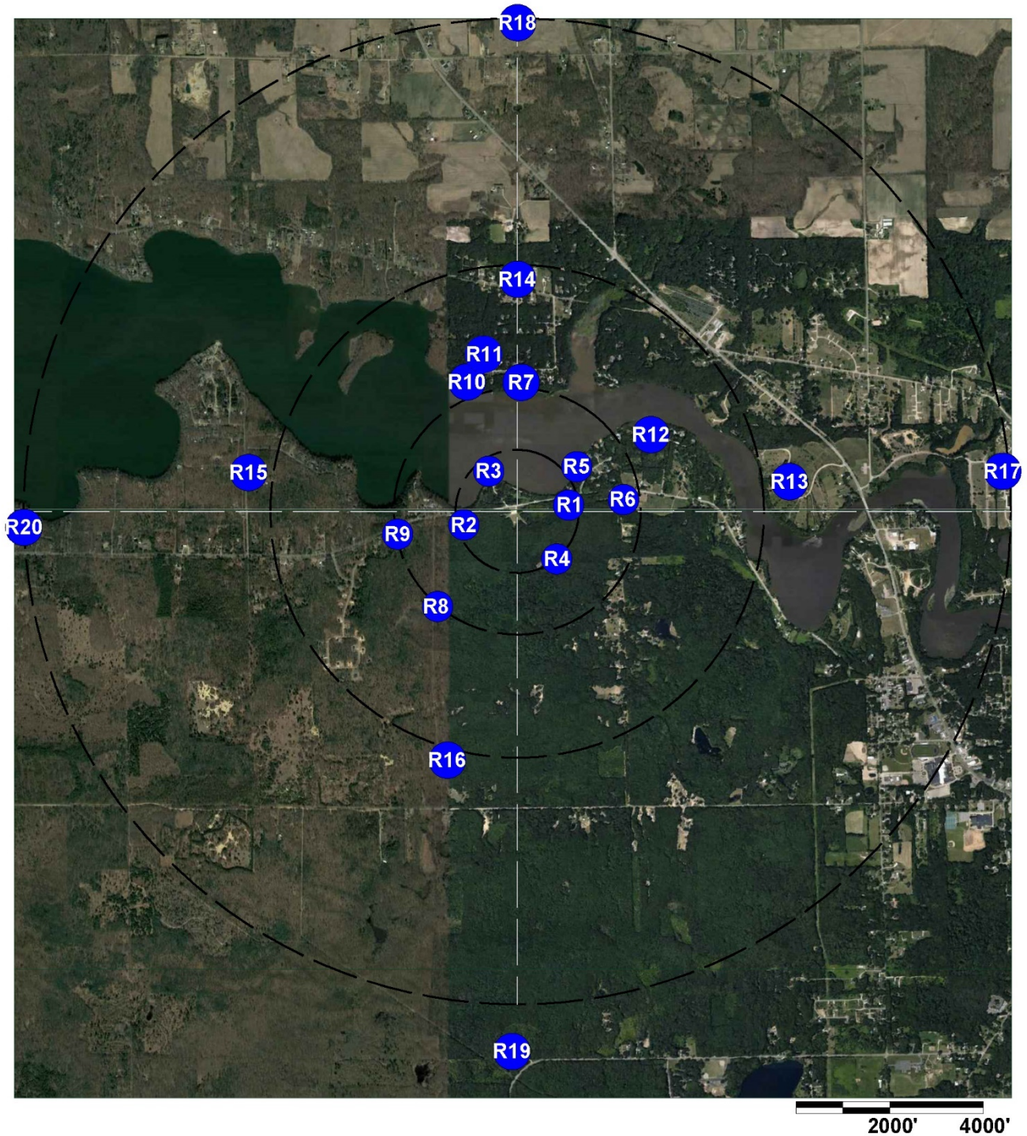
Receiver Direction Relative to Direction of Gunfire	Octave Band Sound Exposure Level in dB					
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
Front	111	118	118	119	117	114
Front/Side[1]	108	114	116	117	115	112
Side	104	111	114	115	113	109
Rear/Side[2]	104	109	112	113	112	109
Rear[4]	104	107	110	111	111	108

Notes:
1. Sound levels were interpolated between the Front and Side conditions.
2. Sound levels were interpolated between the Rear and Side conditions.



	RECEIVERS	COMPUTER MODEL SCENARIOS (Estimated Insertion Loss Relative to the Range from 2016)									ORIENTATION RELATIVE TO D.O.F
		2016	A	B	C	D	E	F	G	H	
1	0.20 mi ENE - 2M - old/new	0	-3	-4	-5	-13	-15	-14	-14	-18	SIDE-REAR
2	0.25 mi W - 4M - old/new	0	-12	-14	-14	-14	-14	-14	-14	-15	SIDE-FRONT
3	0.25 mi NNW - 1M - old/new	0	-1	-1	-1	-5	-7	-6	-8	-10	SIDE-REAR
4	0.25 mi SE - 2T old/new	0	-17	-19	-19	-19	-19	-19	-19	-19	SIDE-FRONT
5	0.29 mi - NNE - AS2	0	2	2	2	1	-2	2	-5	-10	REAR
6	0.43 mi ENE - 6M - old/new	0	-9	-10	-10	-10	-10	-10	-13	-14	SIDE
7	0.50 mi N - 5M - old/new	0	0	0	0	-5	-8	-5	-10	-16	REAR
8	0.50 mi SW – 7T - old/new	0	-8	-5	-5	-5	-5	-5	-8	-8	FRONT
9	0.51 mi W - 8M - old/new	0	-12	-14	-14	-14	-14	-14	-12	-15	FRONT-SIDE
10	1.60 mi NNW - AS1A - new	0	1	1	1	-1	-3	-3	-5	-10	REAR
11	1.60 mi N - AS1B - new	0	0	0	0	-4	-6	-4	-9	-13	REAR
12	0.62 mi NNE - AS3	0	0	0	0	0	0	0	-4	-7	SIDE-REAR
13	1.00 mi E - 11M - old/new	0	-15	-15	-15	-15	-15	-15	-15	-15	SIDE
14	1.00 mi N - 10M - old/new	0	-4	-4	-4	-4	-5	-4	-6	-11	REAR
15	1.10 mi W -14M - old/new	0	-13	-13	-13	-13	-14	-14	-13	-14	SIDE-REAR
16	1.10 mi SSW - 13M New - old/new	0	-1	-1	-1	-1	-1	-1	-1	-1	FRONT
17	2.00 mi E - 16M - old/new	0	-13	-13	-13	-13	-13	-13	-13	-14	SIDE
18	2.00 mi N - 15M - old/new	0	0	0	0	-1	-4	-2	-7	-10	REAR
19	2.00 mi S - 17M - old/new	0	-6	-6	-6	-6	-6	-6	-6	-6	FRONT
20	2.00 mi W - 18M - old/new	0	-10	-10	-10	-10	-11	-11	-10	-11	SIDE
		Firing Range in its Original Configuration in 2016	**Model A:** Firing range with initial phase of noise mitigation	**Model B:** Extend side berms; add 10 ft. tall wall above berms	**Model C:** Model B w/extended berm within property line	**Model D:** Model C; 10 ft. wall rear wall across facility	**Model E:** Model C; 20 ft. tall rear wall across facility	**Model F:** Site entry relocated; 20 ft. tall walls above side [illegible]	**Model G:** Model A and 14 ft. tall shed rear walls	**Model H:** Model F and 14 ft. tall shed rear walls	

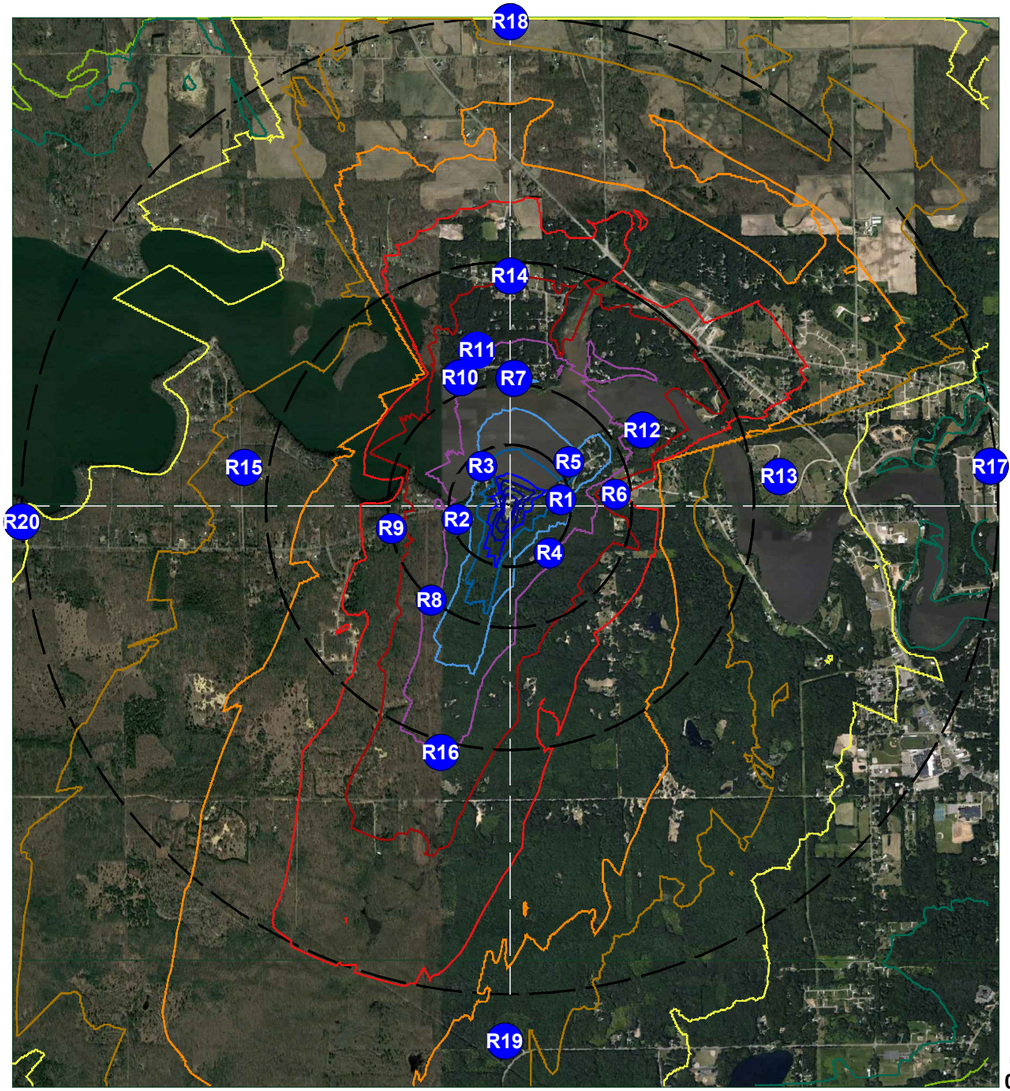
Figure 1. Summary of resulting insertion loss values for the range prior to any renovations in 2016, and various noise mitigation scenarios



	RECEIVERS	COMPUTER MODEL SCENARIOS (Estimated Insertion Loss Relative to the Range with Initial Phase of Noise Mitigation - Model A)								ORIENTATION RELATIVE TO D.O.F
		A	B	C	D	E	F	G	H	
1	0.20 mi ENE - 2M - old/new	0	-1	-1	-10	-12	-11	-10	-14	SIDE-REAR
2	0.25 mi W - 4M - old/new	0	-1	-1	-1	-2	-2	-2	-2	SIDE-FRONT
3	0.25 mi NNW - 1M - old/new	0	0	0	-5	-7	-5	-8	-10	SIDE-REAR
4	0.25 mi SE - 2T old/new	0	-2	-2	-2	-2	-2	-2	-2	SIDE-FRONT
5	0.29 mi - NNE - AS2	0	0	0	-1	-4	0	-7	-12	REAR
6	0.43 mi ENE - 6M - old/new	0	-1	-1	-1	-1	-1	-4	-4	SIDE
7	0.50 mi N - 5M - old/new	0	0	0	-5	-8	-5	-10	-16	REAR
8	0.50 mi SW – 7T - old/new	0	2	2	2	2	2	0	0	FRONT
9	0.51 mi W - 8M - old/new	0	-2	-2	-2	-2	-2	-1	-3	FRONT-SIDE
10	1.60 mi NNW - AS1A - new	0	0	0	-2	-4	-4	-6	-11	REAR
11	1.60 mi N - AS1B - new	0	0	0	-4	-6	-4	-9	-13	REAR
12	0.62 mi NNE - AS3	0	0	0	0	0	0	-4	-8	SIDE-REAR
13	1.00 mi E - 11M - old/new	0	0	0	0	0	0	0	0	SIDE
14	1.00 mi N - 10M - old/new	0	0	0	0	-1	0	-2	-7	REAR
15	1.10 mi W -14M - old/new	0	0	0	0	-1	-1	0	-1	SIDE-REAR
16	1.10 mi SSW - 13M New - old/new	0	0	0	0	0	0	0	0	FRONT
17	2.00 mi E - 16M - old/new	0	0	0	0	0	0	0	0	SIDE
18	2.00 mi N - 15M - old/new	0	0	0	-1	-4	-2	-7	-10	REAR
19	2.00 mi S - 17M - old/new	0	0	0	0	0	0	0	0	FRONT
20	2.00 mi W - 18M - old/new	0	0	0	0	-1	-1	0	-2	SIDE
		Model A: Firing range with initial phase of noise mitigation	**Model B:** Extend side berms; add 10 ft. tall wall above berms	**Model C:** Model B w/extended berm within property line	**Model D:** Model C; 10 ft. wall rear wall across facility	**Model E:** Model C; 20 ft. tall rear wall across facility	**Model F:** Site entry relocated; 20 ft. tall walls above side berms; 20 ft. rear walls	**Model G:** Model A and 14 ft. tall shed rear walls	**Model H:** Model F and 14 ft. tall shed rear walls	

Figure 2. Summary of resulting insertion loss values for the current firing range with the initial phase of noise mitigation and various noise mitigation scenarios

NOISE CONTOUR MAP



NOISE CONTOUR LEVELS

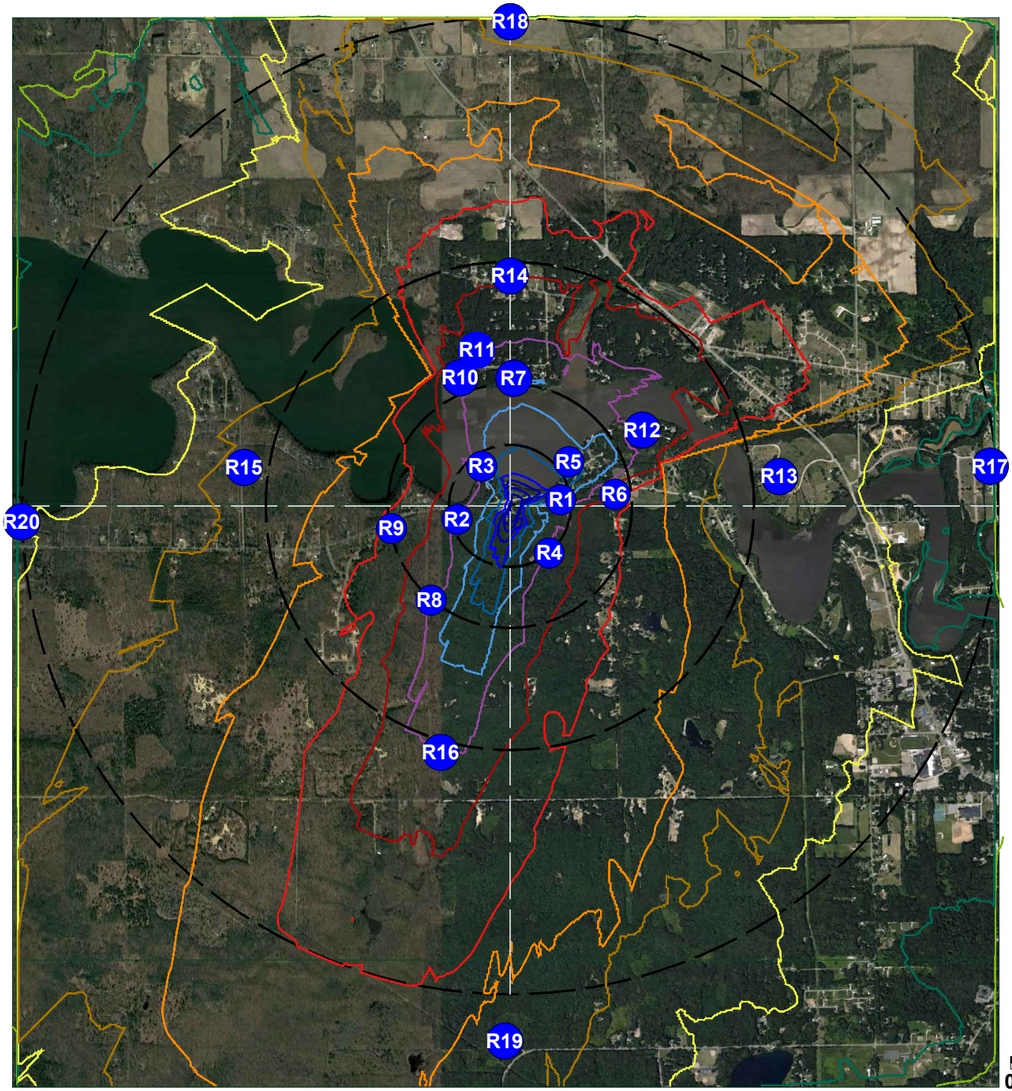
90 dBA	60 dBA
85 dBA	55 dBA
80 dBA	50 dBA
75 dBA	45 dBA
70 dBA	40 dBA
65 dBA	35 dBA

MODEL A: 15' tall side berms and sheds

NOISE SENSITIVE RECEIVERS		ESTIMATED INSERTION LOSS RANGE YR. 2016
R1	0.20 mi ENE - 2M - old/new	-3
R2	0.25 mi W - 4M - old/new	-12
R3	0.25 mi NNW - 1M - old/new	-1
R4	0.25 mi SE - 2T old/new	-17
R5	0.29 mi - NNE - AS2	+2
R6	0.43 mi ENE - 6M - old/new	-9
R7	0.50 mi N - 5M - old/new	0
R8	0.50 mi SW - 7T - old/new	-8
R9	0.51 mi W - 8M - old/new	-12
R10	1.60 mi NNW - AS1A - new	+1
R11	1.60 mi N - AS1B - new	0
R12	0.62 mi NNE - AS3	0
R13	1.00 mi E - 11M - old/new	-15
R14	1.00 mi N - 10M - old/new	-4
R15	1.10 mi W -14M - old/new	-13
R16	1.10 mi SSW - 13M New - old/new	-1
R17	2.00 mi E - 16M - old/new	-13
R18	2.00 mi N - 15M - old/new	0
R19	2.00 mi S - 17M - old/new	-6
R20	2.00 mi W - 18M - old/new	-10

Figure 3. Aerial map showing the resulting noise contours from the existing firing range | Model A

NOISE CONTOUR MAP



NOISE CONTOUR LEVELS

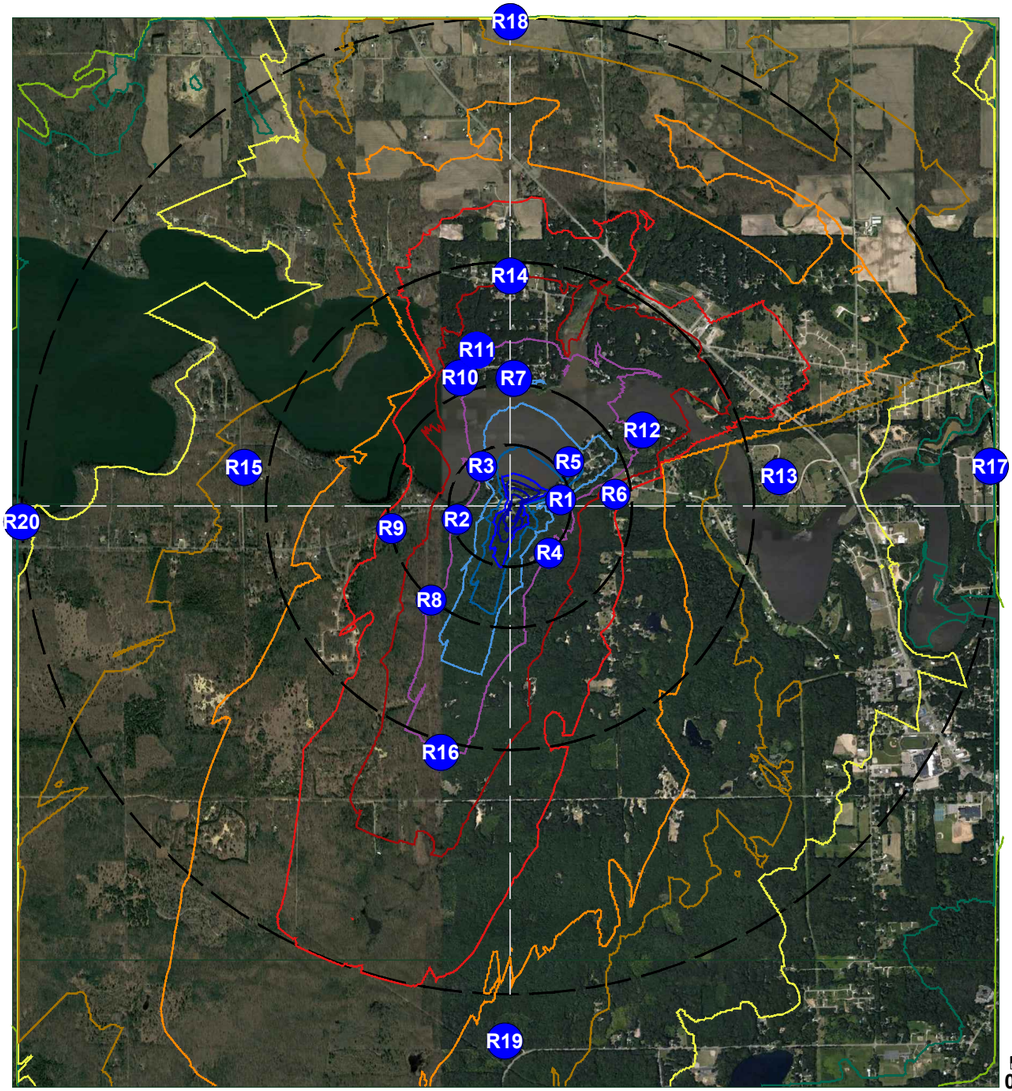
90 dBA	60 dBA
85 dBA	55 dBA
80 dBA	50 dBA
75 dBA	45 dBA
70 dBA	40 dBA
65 dBA	35 dBA

MODEL B: extend side bermon east side of range; add 10' tall wall above berms

NOISE SENSITIVE RECEIVERS		ESTIMATED INSERTION LOSS RANGE YR. 2016	ESTIMATED INSERTION LOSS CURRENT RANGE YR. 2021
R1	0.20 mi ENE - 2M - old/new	-4	-1
R2	0.25 mi W - 4M - old/new	-14	-1
R3	0.25 mi NNW - 1M - old/new	-1	0
R4	0.25 mi SE - 2T old/new	-19	-2
R5	0.29 mi - NNE - AS2	+2	0
R6	0.43 mi ENE - 6M - old/new	-10	-1
R7	0.50 mi N - 5M - old/new	0	0
R8	0.50 mi SW - 7T - old/new	-5	+2
R9	0.51 mi W - 8M - old/new	-14	-2
R10	1.60 mi NNW - AS1A - new	+1	0
R11	1.60 mi N - AS1B - new	0	0
R12	0.62 mi NNE - AS3	0	0
R13	1.00 mi E - 11M - old/new	-15	0
R14	1.00 mi N - 10M - old/new	-4	0
R15	1.10 mi W -14M - old/new	-13	0
R16	1.10 mi SSW - 13M New - old/new	-1	0
R17	2.00 mi E - 16M - old/new	-13	0
R18	2.00 mi N - 15M - old/new	0	0
R19	2.00 mi S - 17M - old/new	-6	0
R20	2.00 mi W - 18M - old/new	-10	0

Figure 4. Aerial map showing the resulting noise contours from the existing firing range | Model B

NOISE CONTOUR MAP



NOISE CONTOUR LEVELS

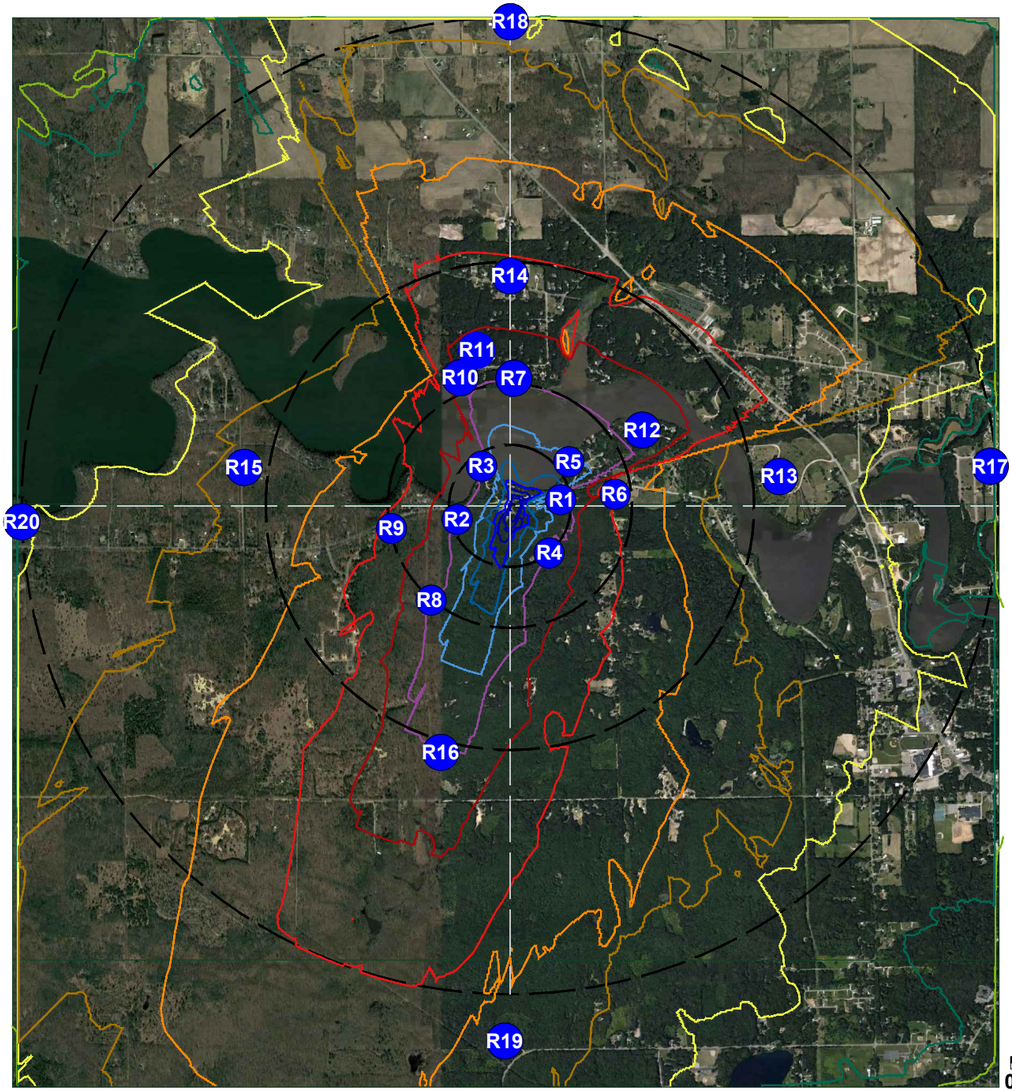
90 dBA	60 dBA
85 dBA	55 dBA
80 dBA	50 dBA
75 dBA	45 dBA
70 dBA	40 dBA
65 dBA	35 dBA

MODEL C: Model B with extended berm on the east side of the range to be within property line

NOISE SENSITIVE RECEIVERS		ESTIMATED INSERTION LOSS EXISTING RANGE YR. 2016	ESTIMATED INSERTION LOSS CURRENT RANGE YR. 2021
R1	0.20 mi ENE - 2M - old/new	-5	-1
R2	0.25 mi W - 4M - old/new	-14	-1
R3	0.25 mi NNW - 1M - old/new	-1	0
R4	0.25 mi SE - 2T old/new	-19	-2
R5	0.29 mi - NNE - AS2	+2	0
R6	0.43 mi ENE - 6M - old/new	-10	-1
R7	0.50 mi N - 5M - old/new	0	0
R8	0.50 mi SW - 7T - old/new	-5	+2
R9	0.51 mi W - 8M - old/new	-14	-2
R10	1.60 mi NNW - AS1A - new	+1	0
R11	1.60 mi N - AS1B - new	0	0
R12	0.62 mi NNE - AS3	0	0
R13	1.00 mi E - 11M - old/new	-15	0
R14	1.00 mi N - 10M - old/new	-4	0
R15	1.10 mi W -14M - old/new	-13	0
R16	1.10 mi SSW - 13M New - old/new	-1	0
R17	2.00 mi E - 16M - old/new	-13	0
R18	2.00 mi N - 15M - old/new	0	0
R19	2.00 mi S - 17M - old/new	-6	0
R20	2.00 mi W - 18M - old/new	-10	0

Figure 5. Aerial map showing the resulting noise contours from the existing firing range | Model C

NOISE CONTOUR MAP



NOISE CONTOUR LEVELS

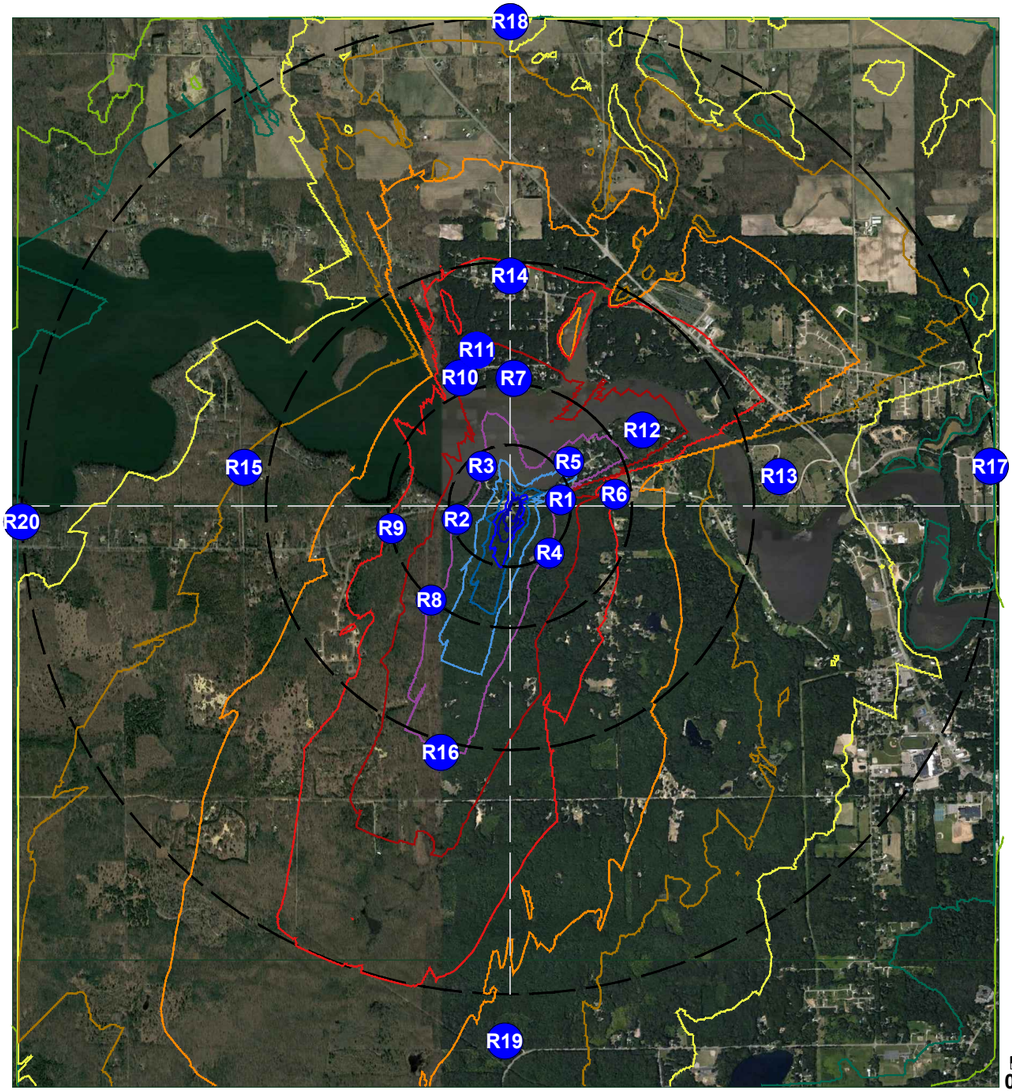
90 dBA	60 dBA
85 dBA	55 dBA
80 dBA	50 dBA
75 dBA	45 dBA
70 dBA	40 dBA
65 dBA	35 dBA

MODEL D: Model C and 10 ft. tall rear wall across facility

NOISE SENSITIVE RECEIVERS		ESTIMATED INSERTION LOSS* EXISTING RANGE YR. 2016	ESTIMATED INSERTION LOSS* CURRENT RANGE YR. 2021
R1	0.20 mi ENE - 2M - old/new	-13	-10
R2	0.25 mi W - 4M - old/new	-14	-1
R3	0.25 mi NNW - 1M - old/new	-5	-5
R4	0.25 mi SE - 2T old/new	-19	-2
R5	0.29 mi - NNE - AS2	+1	-1
R6	0.43 mi ENE - 6M - old/new	-10	-1
R7	0.50 mi N - 5M - old/new	-5	-5
R8	0.50 mi SW - 7T - old/new	-5	+2
R9	0.51 mi W - 8M - old/new	-14	-2
R10	1.60 mi NNW - AS1A - new	-1	-2
R11	1.60 mi N - AS1B - new	-4	-4
R12	0.62 mi NNE - AS3	0	0
R13	1.00 mi E - 11M - old/new	-15	0
R14	1.00 mi N - 10M - old/new	-4	0
R15	1.10 mi W -14M - old/new	-13	0
R16	1.10 mi SSW - 13M New - old/new	-1	0
R17	2.00 mi E - 16M - old/new	-13	0
R18	2.00 mi N - 15M - old/new	-1	-1
R19	2.00 mi S - 17M - old/new	-6	0
R20	2.00 mi W - 18M - old/new	-10	0

Figure 6. Aerial map showing the resulting noise contours from the existing firing range | Model D

NOISE CONTOUR MAP



NOISE CONTOUR LEVELS

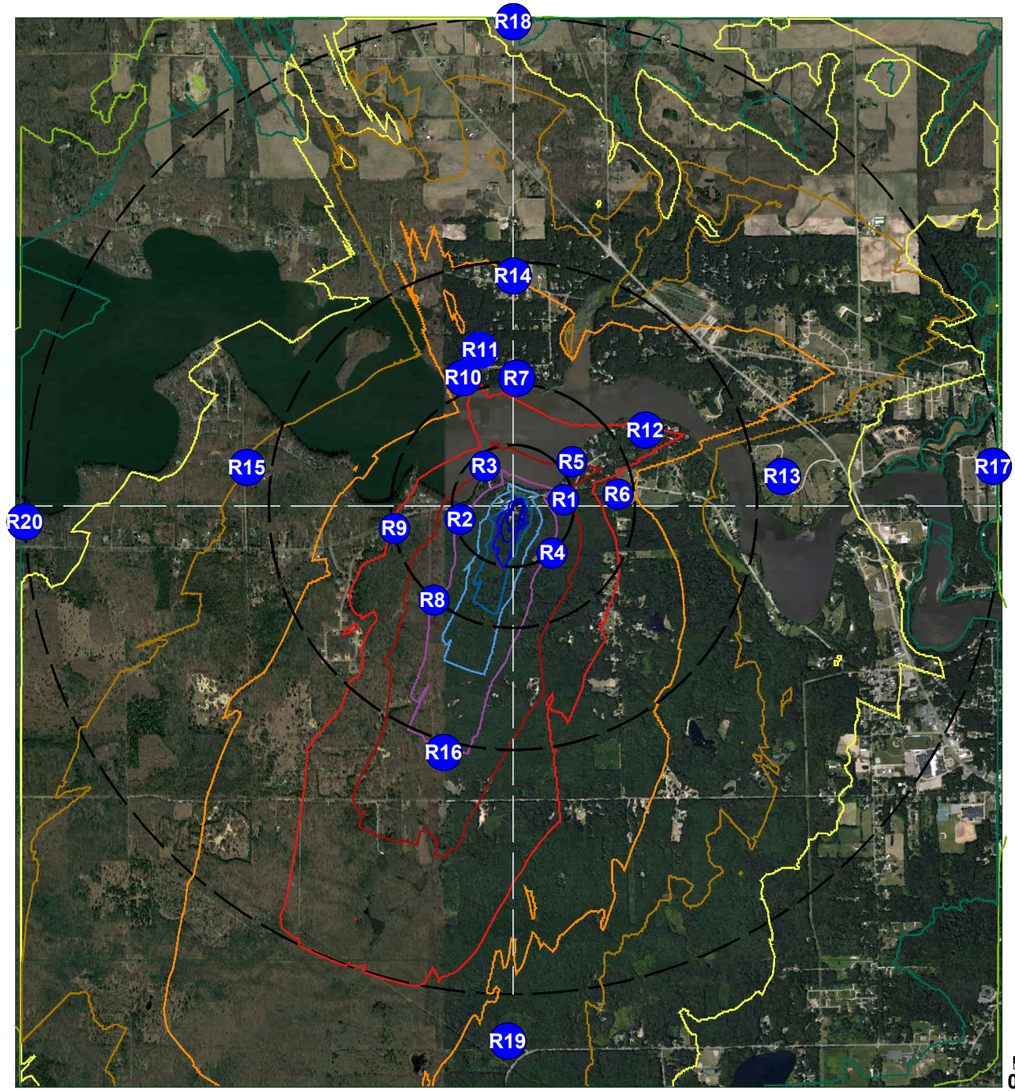
90 dBA	60 dBA
85 dBA	55 dBA
80 dBA	50 dBA
75 dBA	45 dBA
70 dBA	40 dBA
65 dBA	35 dBA

MODEL E: Model C and 20 ft. tall rear wall across facility

NOISE SENSITIVE RECEIVERS		ESTIMATED INSERTION LOSS* EXISTING RANGE YR. 2016	ESTIMATED INSERTION LOSS* CURRENT RANGE YR. 2021
R1	0.20 mi ENE - 2M - old/new	-15	-12
R2	0.25 mi W - 4M - old/new	-14	-2
R3	0.25 mi NNW - 1M - old/new	-7	-7
R4	0.25 mi SE - 2T old/new	-19	-2
R5	0.29 mi - NNE - AS2	-2	-4
R6	0.43 mi ENE - 6M - old/new	-10	-1
R7	0.50 mi N - 5M - old/new	-8	-8
R8	0.50 mi SW - 7T - old/new	-5	+2
R9	0.51 mi W - 8M - old/new	-14	-2
R10	1.60 mi NNW - AS1A - new	-3	-4
R11	1.60 mi N - AS1B - new	-6	-6
R12	0.62 mi NNE - AS3	0	0
R13	1.00 mi E - 11M - old/new	-15	0
R14	1.00 mi N - 10M - old/new	-5	-1
R15	1.10 mi W -14M - old/new	-14	-1
R16	1.10 mi SSW - 13M New - old/new	-1	0
R17	2.00 mi E - 16M - old/new	-13	0
R18	2.00 mi N - 15M - old/new	-4	-4
R19	2.00 mi S - 17M - old/new	-6	0
R20	2.00 mi W - 18M - old/new	-11	-1

Figure 7. Aerial map showing the resulting noise contours from the existing firing range | Model E

NOISE CONTOUR MAP



NOISE CONTOUR LEVELS

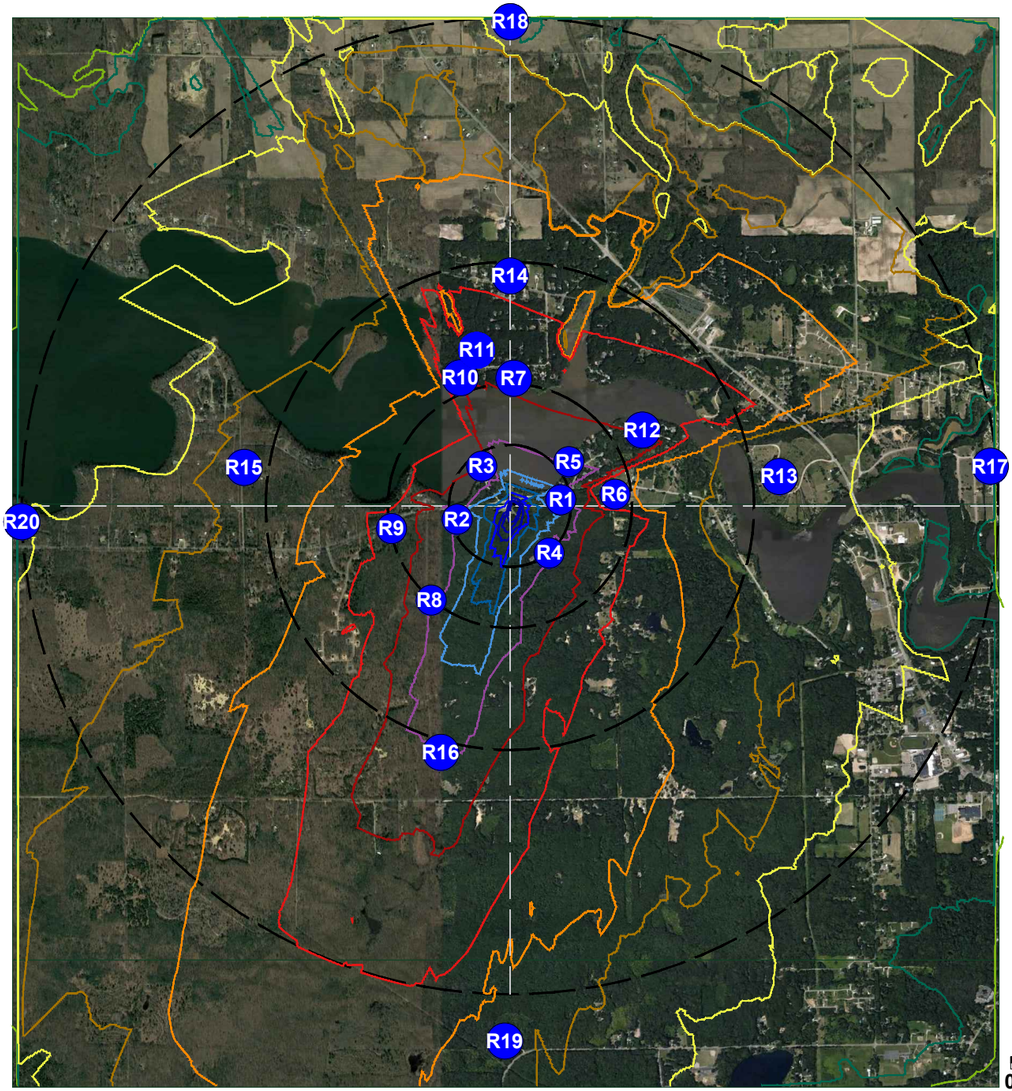
90 dBA	60 dBA
85 dBA	55 dBA
80 dBA	50 dBA
75 dBA	45 dBA
70 dBA	40 dBA
65 dBA	35 dBA

MODEL F: Entry to site relocated to the northeast; side berms extended; 20 ft. tall rear walls behind range, and 20 ft. tall walls above side berms

NOISE SENSITIVE RECEIVERS		ESTIMATED INSERTION LOSS* EXISTING RANGE YR. 2016	ESTIMATED INSERTION LOSS* CURRENT RANGE YR. 2021
R1	0.20 mi ENE - 2M - old/new	-14	-11
R2	0.25 mi W - 4M - old/new	-14	-2
R3	0.25 mi NNW - 1M - old/new	-6	-5
R4	0.25 mi SE - 2T old/new	-19	-2
R5	0.29 mi - NNE - AS2	+2	0
R6	0.43 mi ENE - 6M - old/new	-10	-1
R7	0.50 mi N - 5M - old/new	-5	-5
R8	0.50 mi SW - 7T - old/new	-5	+2
R9	0.51 mi W - 8M - old/new	-14	-2
R10	1.60 mi NNW - AS1A - new	-3	-4
R11	1.60 mi N - AS1B - new	-4	-4
R12	0.62 mi NNE - AS3	0	0
R13	1.00 mi E - 11M - old/new	-15	0
R14	1.00 mi N - 10M - old/new	-4	0
R15	1.10 mi W -14M - old/new	-14	-1
R16	1.10 mi SSW - 13M New - old/new	-1	0
R17	2.00 mi E - 16M - old/new	-13	0
R18	2.00 mi N - 15M - old/new	-2	-2
R19	2.00 mi S - 17M - old/new	-6	0
R20	2.00 mi W - 18M - old/new	-11	-1

Figure 8. Aerial map showing the resulting noise contours from the existing firing range | Model F

NOISE CONTOUR MAP



NOISE CONTOUR LEVELS

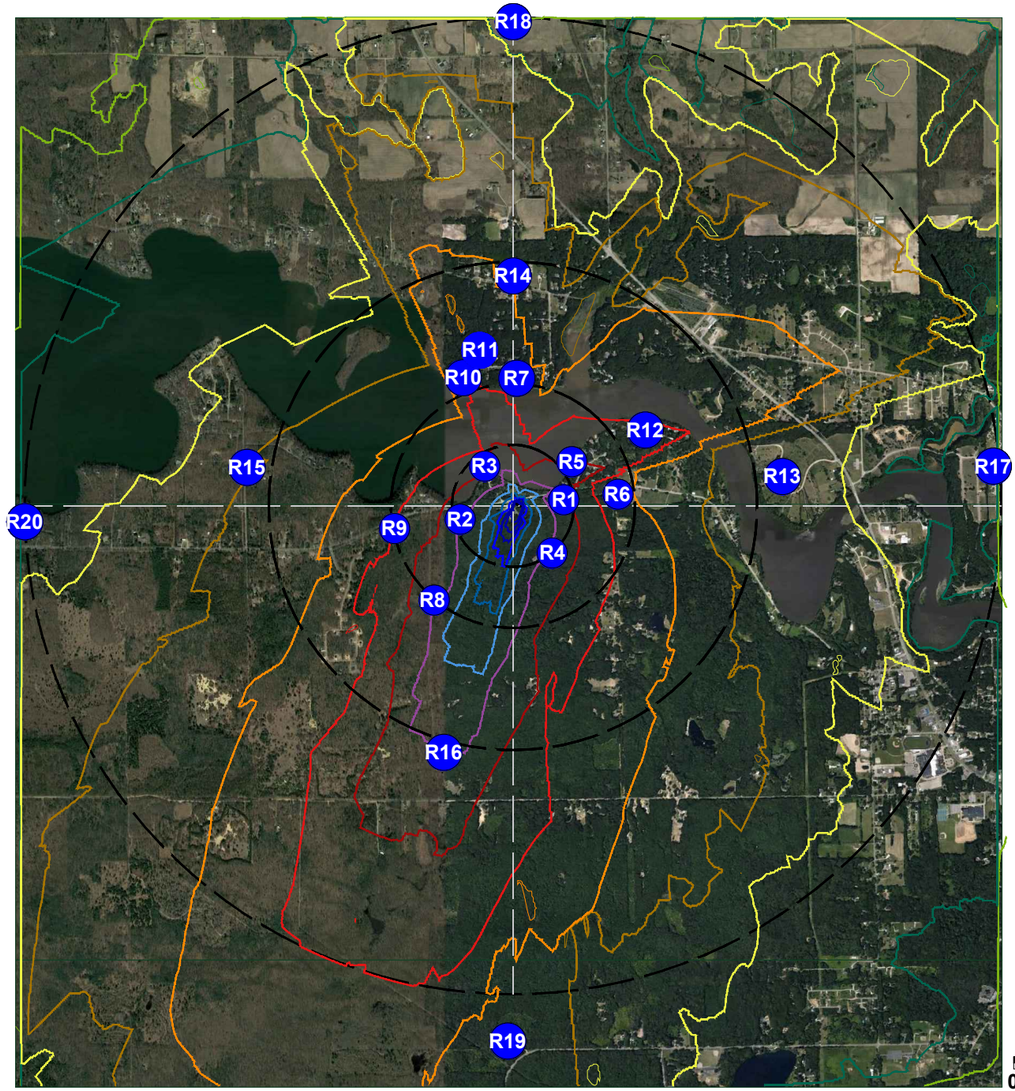
90 dBA	60 dBA
85 dBA	55 dBA
80 dBA	50 dBA
75 dBA	45 dBA
70 dBA	40 dBA
65 dBA	35 dBA

MODEL G: Model A and 14 ft. tall shed rear walls

NOISE SENSITIVE RECEIVERS		ESTIMATED INSERTION LOSS* EXISTING RANGE YR. 2016	ESTIMATED INSERTION LOSS* CURRENT RANGE YR. 2021
R1	0.20 mi ENE - 2M - old/new	-14	-10
R2	0.25 mi W - 4M - old/new	-14	-2
R3	0.25 mi NNW - 1M - old/new	-8	-8
R4	0.25 mi SE - 2T old/new	-19	-2
R5	0.29 mi - NNE - AS2	-5	-7
R6	0.43 mi ENE - 6M - old/new	-13	-4
R7	0.50 mi N - 5M - old/new	-10	-10
R8	0.50 mi SW - 7T - old/new	-8	0
R9	0.51 mi W - 8M - old/new	-12	-1
R10	1.60 mi NNW - AS1A - new	-5	-6
R11	1.60 mi N - AS1B - new	-9	-9
R12	0.62 mi NNE - AS3	-4	-4
R13	1.00 mi E - 11M - old/new	-15	0
R14	1.00 mi N - 10M - old/new	-6	-2
R15	1.10 mi W -14M - old/new	-13	0
R16	1.10 mi SSW - 13M New - old/new	-1	0
R17	2.00 mi E - 16M - old/new	-13	0
R18	2.00 mi N - 15M - old/new	-7	-7
R19	2.00 mi S - 17M - old/new	-6	0
R20	2.00 mi W - 18M - old/new	-10	0

Figure 9. Aerial map showing the resulting noise contours from the existing firing range | Model G

NOISE CONTOUR MAP



NOISE CONTOUR LEVELS

90 dBA	**60 dBA**
85 dBA	**55 dBA**
80 dBA	**50 dBA**
75 dBA	**45 dBA**
70 dBA	**40 dBA**
65 dBA	**35 dBA**

MODEL H: Entry to site relocated to the northeast; side berms extended; 20 ft. tall rear walls behind range, 20 ft. tall walls above side berms; and 14 ft. tall shed rear walls

NOISE SENSITIVE RECEIVERS		ESTIMATED INSERTION LOSS* EXISTING RANGE YR. 2016	ESTIMATED INSERTION LOSS* CURRENT RANGE YR. 2021
R1	0.20 mi ENE - 2M - old/new	-18	-14
R2	0.25 mi W - 4M - old/new	-15	-2
R3	0.25 mi NNW - 1M - old/new	-10	-10
R4	0.25 mi SE - 2T old/new	-19	-2
R5	0.29 mi - NNE - AS2	-10	-12
R6	0.43 mi ENE - 6M - old/new	-14	-4
R7	0.50 mi N - 5M - old/new	-16	-16
R8	0.50 mi SW - 7T - old/new	-8	0
R9	0.51 mi W - 8M - old/new	-15	-3
R10	1.60 mi NNW - AS1A - new	-10	-11
R11	1.60 mi N - AS1B - new	-13	-13
R12	0.62 mi NNE - AS3	-7	-8
R13	1.00 mi E - 11M - old/new	-15	0
R14	1.00 mi N - 10M - old/new	-11	-7
R15	1.10 mi W -14M - old/new	-14	-1
R16	1.10 mi SSW - 13M New - old/new	-1	0
R17	2.00 mi E - 16M - old/new	-14	0
R18	2.00 mi N - 15M - old/new	-10	-10
R19	2.00 mi S - 17M - old/new	-6	0
R20	2.00 mi W - 18M - old/new	-11	-2

Figure 10. Aerial map showing the resulting noise contours from the existing firing range | Model H

APPENDIX G: LIST OF GPS LOCATIONS FOR THE MEASUREMENT LOCATIONS OF THE EXISTING AMBIENT SOUND LEVELS AND THE SOUNDS OF FIREARMS EXPERIMENTS IN 2016 AND 2021

Table G-1. List of GPS coordinates for the locations where measurements of the existing ambient sound levels and sounds of firearms were measured during the 2016 and 2021 field studies near the existing Echo Point Shooting Range in Allegan, Michigan.

Receiver Location	North Coordinate	West Coordinate	Elevation
2016 and 2021 Measurement Locations			
1M	N42° 32.825'	W85° 54.448'	620 ft.
2M	N42° 32.722'	W85° 54.133'	650 ft.
2T	N42° 32.534'	W85° 54.157'	680 ft.
4M	N42° 32.699'	W85° 54.671'	640 ft.
5M	N42° 33.142'	W85° 54.361'	660 ft.
6M	N42° 32.712'	W85° 53.798'	640 ft.
7T	N42° 32.348'	W85° 54.732'	660 ft.
8M	N42° 32.621'	W85° 54.961'	690 ft.
10M	N42° 33.515'	W85° 54.397'	624 ft.
11M	N42° 32.777'	W85° 53.108'	630 ft.
13 New	N42° 31.840'	W85° 54.706'	700 ft.
14M	N42° 32.715'	W85° 55.612'	690 ft.
15M	N42° 34.417'	W85° 54.433'	770 ft.
16M	N42° 32.708'	W85° 52.023'	650 ft.
17M	N42° 30.805'	W85° 54.373'	750 ft.
18M	N42° 32.659'	W85° 56.728'	660 ft.
Additional 2021 Measurement Locations			
AS1A	N42° 33.178'	W85° 54.580'	679 ft.
AS1B	N42° 33.218'	W85° 54.490'	634 ft.
AS2	N42° 32.837'	W85° 54.088'	630 ft.
AS3	N42° 32.955'	W85° 53.730'	618 ft.

APPENDIX H:

STAFFING AND QUALIFICATIONS

FIRM QUALIFICATIONS

Siebein Associates, Inc. established in 1981 in Gainesville, Florida is a leading acoustical consulting firm that specializes in sound assessment and analysis for shooting ranges and noise mitigation design for facilities using a variety of small arms, heavy weapons, field measurement; research; development of computer programs; and design of state, federal, public, and military and police training facilities. This has included work for firing ranges around the world for the US military, federal agencies such as the FBI, Capitol Police and FLETC as well as police training and privately owned ranges. We have also conducted research on firearms noise measurement and mitigation for the National Rifle Association and the National Science Foundation.

The firm has worked on over 2,300 projects worldwide and is very experienced with work on police and recreational shooting facilities in the vicinity of residential neighborhoods. We have also worked with a number of municipalities to develop noise ordinances, participated in public hearings for noise impact related work, and worked on ANSI and ASTM committees to draft acoustical standards. Measurement, modeling and prediction of noise levels from impulsive sounds like gun fire in complex environments using field measures, computer models, and auralizations is a particular strength of the firm.

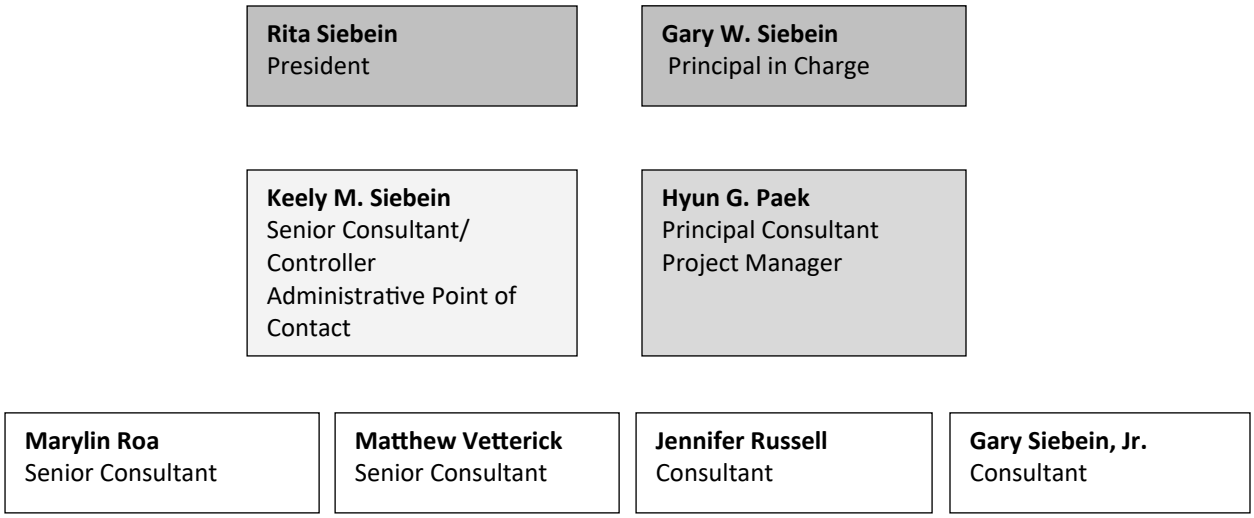


Figure 1. Organizational Chart

Table 1. Staff Roles and Responsibilities

Name	Role	Responsibility
Gary W. Siebein, FASA, FAIA	Principal-in-Charge	Experimental Design Field Measurements Quality Control Review of Work
Hyun Paek, ASA, INCE	Project Manager	Experimental Design Field Measurements Manage Data Analysis and Report Production
Keely Siebein, ASA, INCE, LEED AP BD+C	Administrative Point of Contact	Qualification and Proposal Preparation, Data Review
Gary Siebein, Jr., CTS, AVT	Environmental Noise Measurement, Consultant	Project Data Analysis and Field Measurements
Jennifer Russell, Assoc. AIA, ASA	Environmental Noise Measurement, Consultant	Project Data Analysis and Field Measurements
Marylin Roa, AIA, ASA, INCE	Senior Consultant	Project Data Analysis and Technical Assistance with Report Preparation
Matthew Vetterick, AIA, NCARB	Senior Consultant	Technical Assistance with Report Preparation

SELECTED PROJECT EXPERIENCE

ASYMMETRIC WARFARE GROUP INDOOR FIRING RANGE

Fort AP Hill, Virginia

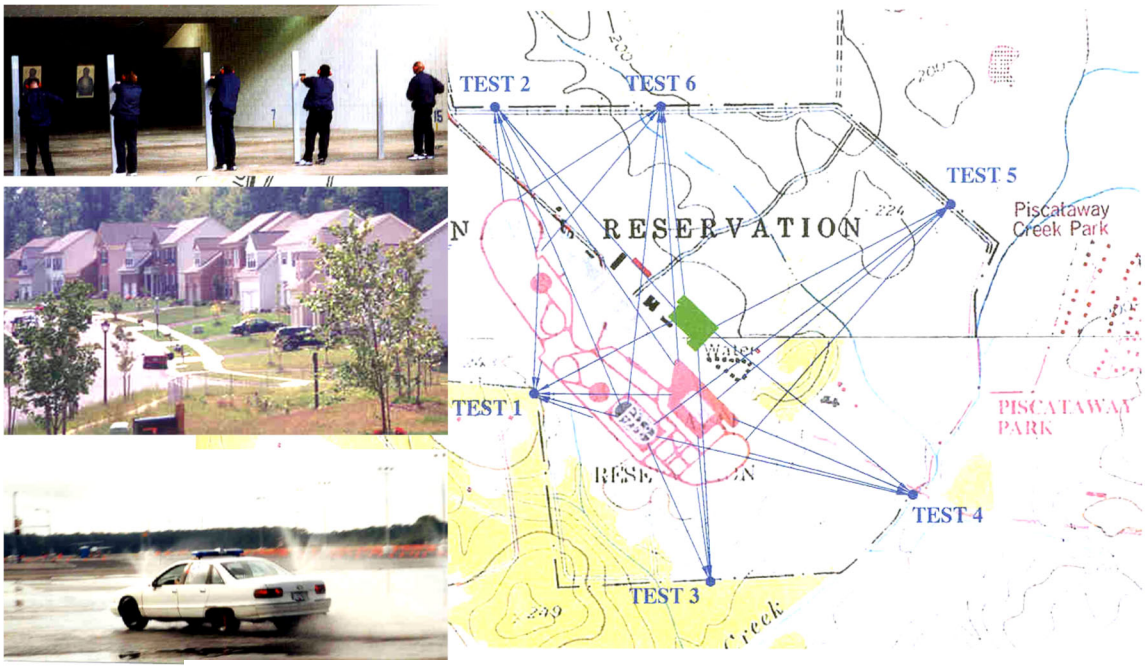
Siebein Associates, Inc. consultants constructed a state-of-the-art acoustical measurement instrumentation system in house to conduct short term acoustical measurements of overall-A-weighted and Z-weighted sound levels produced by firearms operations at the AWG 50M Indoor Range at Fort AP Hill. The measurements were taken as part of a study to validate the effectiveness of custom sound absorbent materials in firing ranges.

Prior to the installation of the acoustics panels, Siebein Associates consultants took acoustical measurements at four different locations inside the AWG Firing Range from three shooters firing three rounds in succession from M9 Beretta 9mm handguns, M4 Colt 5.56 rifles, and MK11 Mod 0, 7.62 caliber rifles. Three microphones with preamplifiers were placed two lanes over from the shooters at 15, 25, and 50 meters from the targets to record the sound levels. Additionally, a high pressure microphone was placed three meters from the shooters along with another high pressure microphone with preamplifier that was connected to a CESVA sound level meter.

The high pressure microphone that was not recording to the CESVA was connected to an 8 Channel Data Acquisition System along with the three microphones. The data acquisition system digitized the data and transferred it to a laptop computer that acquired the four channels of data using Multi-Track Recording software.

To complete the study, the consultants traveled back to Fort AP Hill after the acoustical treatments had been applied inside the AWG Range and conducted identical tests that proved the addition of the sound absorbent material was successful in significantly reducing the sound levels.

SELECTED PROJECT EXPERIENCE

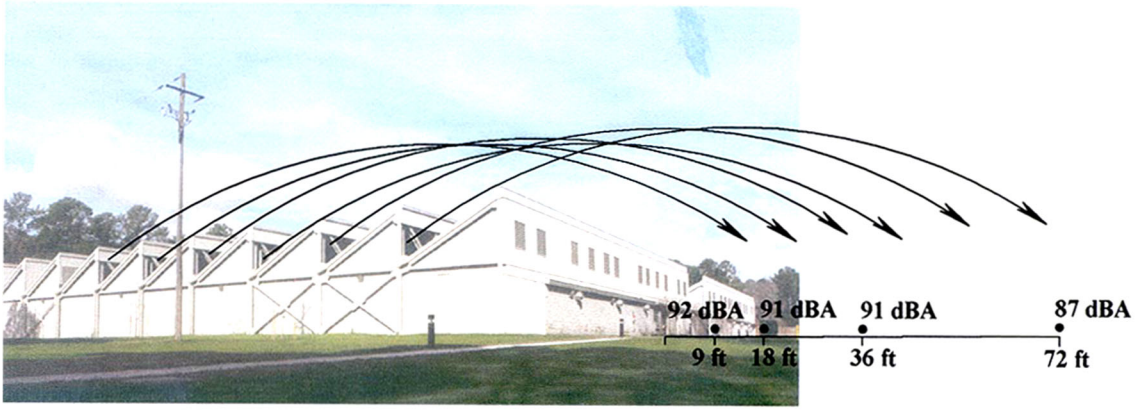


FEDERAL LAW ENFORCEMENT TRAINING CENTER (FLETC)

Cheltenham, Maryland

Siebein Associates conducted a sound assessment and noise analysis for new enclosed firing ranges and driving training facilities on nearby communities. Noise measurement levels were taken at over 40 locations in the community and the existing sonic environment was characterized using a combination of quantitative metrics such as Ldn's and soundscape terms. Field measurements were conducted of long term sound levels and individual event levels for firearms training at multiple indoor, partially enclosed and outdoor firing ranges at an existing facility. The data was used as source data in computer model studies using the SA Environmental Noise Analysis program of noise impacts from a number of design alternatives. The field measurements were also made at distances away from the sources that would be found at the proposed facility as a method to calibrate the model studies. A variety of mitigation options were explored and recommendations presented.

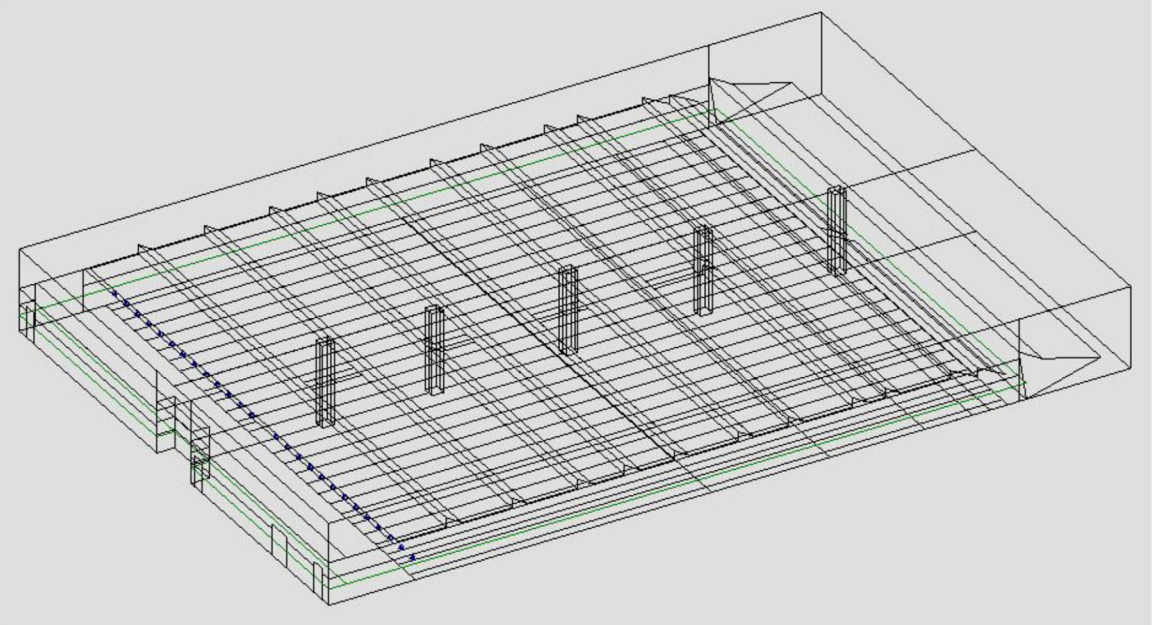
SELECTED PROJECT EXPERIENCE



FEDERAL LAW ENFORCEMENT TRAINING CENTER (FLETC)
Brunswick, Georgia

Siebein Associates conducted a sound assessment and noise analysis new partially enclosed firing ranges on near by communities. Long term sound levels were recorded at critical locations in the community where complaints had been received. Detailed measurements of individual training events were also made both close to the source and in the neighborhoods. These data were used in computer model studies using the SA Environmental Noise Analysis program of design alternatives including range location, orientation, materials and baffling systems. Physical scale models were also built of design options for the partially enclosed ranges to study the directional effects of sound diffracted out through the openings into the community. The effects of moving the sound sources to different firing positions within the range was found to account for much of the variability in acoustical measurements made in the neighborhood in previous studies. Recommendations for to minimize noise propagation into the neighborhood were presented and constructed.

SELECTED PROJECT EXPERIENCE



FEDERAL LAW ENFORCEMENT TRAINING CENTER (FLETC)
Charleston, South Carolina

Siebein Associates provided sound analysis and acoustical design recommendations for indoor firing ranges in Charleston, South Carolina. Mitigation to increase sound absorption and reduce harmful noise propagation was provided. A three-dimensional acoustic computer model was constructed to study sound propagation as shown in the Figure above.

SELECTED PROJECT EXPERIENCE

FBI FIRING RANGE ACOUSTICAL STUDY
Quantico, Virginia

Siebein Associates conducted a comprehensive evaluation of acoustic problems in large indoor/outdoor firing ranges; monitoring of OSHA noise exposure for instructors and students; development of software systems to evaluate hearing conservation issues from high-energy impulse noise from firearms; and integrated acoustical mitigation design for ranges with architectural, air-flow and lead abatement consultants.